

- S1.1a** Formulate questions about natural phenomena.
- S1.1b** Identify appropriate references to investigate a question.
- S1.1c** Refine and clarify questions so that they are subject to scientific investigation.
- S1.2a** Independently formulate a hypothesis.
- S1.2b** Propose a model of a natural phenomenon.
- S1.2c** Differentiate among observations, inferences, predictions, and explanations.
- S1.3** Represent, present, and defend their proposed explanations of everyday observations so that they can be understood and assessed by others.
- S1.4** Seek to clarify, to assess critically, and to reconcile with their own thinking the ideas presented by others, including peers, teachers, authors, and scientists.

**The scientific method is a process used to answer questions about the natural world.**

A **hypothesis** is a predicted answer to a scientific question.

An **inference** is a logical conclusion based on observations and reasoning.

A **theory** is a unifying explanation for a broad range of hypotheses and observations that has been consistently supported by testing.

**Guided  
Instruction**

**DIRECTIONS** Read the following information.

The **scientific method** is the process used to answer questions about the natural world. It usually begins with a question such as, "What do plants need to grow?" This question can be made more specific. You could ask about a specific type of plant, or a specific plant need. A better question would be, "How much water per day does a tomato plant need to produce fruit?"

The next step is to make a prediction, or **hypothesis**, based on observations and facts that are already known. For example, without water, plants wilt and die. A good hypothesis might be "If a tomato plant receives at least one liter of water each day, it will produce fruit."



It is a good idea to look at reference materials in a library or on the Internet. You can learn about other experiments involving tomato plants. This information can help you decide how to set up your experiment, make observations, and collect data.

**Guided Questions**

What is the **scientific method**?

When is a **hypothesis** made?

From your observations and from the data you collect, you can make an **inference**. An inference is a conclusion drawn from observations and reasoning. If you observe two tomato plants, you might see that only the plant that received enough water grew tomatoes. A good inference would be that the plant that did not grow tomatoes did not get enough water. Further experiments could help to come up with an explanation of why a tomato plant needs water to grow tomatoes.

To share your explanation with other people, you could make models. You might use charts, diagrams, pictures, or objects to show different parts of a tomato plant. People may agree or disagree with your ideas. They may ask questions or try experiments of their own. Their explanations may be the same as yours or very different. You may change your mind about why tomato plants need water.

When most people begin to agree on a single explanation, the explanation is called a **theory**. A theory has been tested many times, and most people believe it is true. A good theory is able to explain how something works. With a good theory, you can correctly predict the outcome of an experiment. If new information is discovered, however, that does not support a theory, the theory may be changed.

**Guided Questions**

What is an **inference**?

How can a **theory** be used?

**DIRECTIONS** For each question, write your answer in the spaces provided.

1. What is a hypothesis?

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2. When would an inference be made? What would it be based on?

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3. When does an idea become a theory?

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4. When might a theory be changed?

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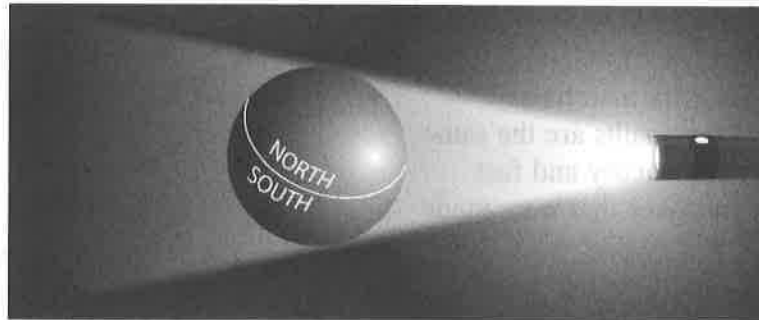
5. Change the following question to make a hypothesis: What is the best brand of golf balls?

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Apply the  
New York State  
Learning Standards  
to the State Test

*Directions (6–9):* For each question, write your answer in the spaces provided. Base your answers to questions 6 through 9 on the paragraph and diagram below.



Maria knows that Earth's tilt affects the directness of sunlight on different parts of Earth. She also knows sunlight helps keep Earth warm. Maria is not sure whether an area on Earth gets more direct sunlight when it is tilted toward the Sun, or away from the Sun. She made a model using a ball to represent Earth and a flashlight to represent the Sun.

- 6 What is a question that Maria can explore with her model?

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- 7 What can you infer about the relationship between direct sunlight and warmth?

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- 8 What is a hypothesis that Maria can make?

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- 9 What can Maria observe with her model? What can she infer?

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*Directions (10–15):* Each question is followed by four choices. Decide which choice is the *best* answer. Circle the number of the answer you have chosen.

**10** When is a hypothesis made?

- (1) after the investigation
- (2) before the investigation starts
- (3) after the results are collected
- (4) before observations and facts are studied

**11** Why would repeating an experiment be a good idea?

- (1) to use up extra materials
- (2) to see if the results are the same
- (3) to test every theory and fact
- (4) to hide mistakes that were made

**12** Which of the following is an observation?

- (1) Our dog is hungry.
- (2) Our dog will bark all night.
- (3) Our dog barked all of last night.
- (4) Our dog barks when he is hungry.

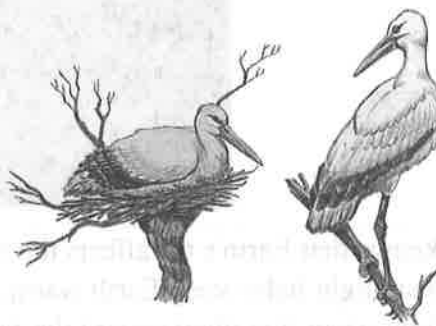
**13** A predicted answer to a question is a(n)

- (1) theory
- (2) inference
- (3) model
- (4) hypothesis

**14** Which of the following questions can be answered by performing an experiment?

- (1) Why do dogs bark?
- (2) What do animals need to live?
- (3) Why do running shoes wear out?
- (4) Which soil will grow the tallest dandelions?

**15** The picture below shows two birds of the same species.



From the picture, you can infer that the bird on the left

- (1) has legs
- (2) has a beak
- (3) is about to lay an egg
- (4) is sitting because it is tired

- S2.1d** Use appropriate tools and conventional techniques to solve problems about the natural world.
- S2.2a** Include appropriate safety procedures.
- S2.2b** Design scientific investigations.
- S2.2c** Design a simple controlled experiment.
- S2.2d** Identify independent variables, dependent variables, and constants in a simple controlled experiment.
- S2.2e** Choose appropriate sample size and number of trials.
- S2.3c** Collect quantitative and qualitative data.
- S3.2b** Identify sources of error and the limitations of data collected.

The **independent variable** is the part of the experiment that the investigator changes.

The **constants** are the variables that are kept the same or controlled in an experiment.

A variable that changes or responds in an experiment is a **dependent variable**.

Each time an experiment is performed is considered a **trial**.

Guided  
Instruction

**DIRECTIONS** Read the following information.

A scientific experiment is designed and carried out to test a hypothesis. In a simple controlled experiment, the investigator should change only one condition at a time. This condition is called the **independent variable**. For example, in an experiment on plants, the independent variable might be the amount of water the plant receives. Some plants will receive more water and other plants will receive less.

All other conditions are exactly the same for each plant. Every plant gets the same type of fertilizer or soil, the same amount of light—even the same size pot. These conditions are called **constants**. If everything else is kept constant, any differences between plants are probably due to differences in the independent variable.



Guided Questions

What is an **independent variable**?

What are **constants**?

Differences between the plants that receive various amounts of water in the experiment are called **dependent variables**. These differences, such as plant height, seed weight, or leaf color are recorded to obtain the results of an investigation. Some results, such as plant height and seed weight, can be measured. Other results, such as leaf color, can only be observed and described.

Each time an experiment is performed is considered a **trial**. In order to get accurate results, it is important to have many trials in an investigation. It is unlikely that the same mistake will be repeated in different trials.

In order to carry out investigations and collect the necessary data, scientists must be familiar with the tools used in scientific investigations. Tools such as microscopes, telescopes, and cameras help scientists make observations. Scales, balances, and thermometers are examples of tools used to make measurements. No matter what types of tools are being used, scientists must follow appropriate safety procedures.

**Guided Questions**

What are **dependent variables**?

Why is it important to have multiple **trials**?

**DIRECTIONS** For each questions, write your answer in the spaces provided.

1. Describe a constant in an experiment.

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2. Why does the investigator in an experiment change only one variable?

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3. Why is it important to conduct multiple trials in an investigation?

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4. Describe an experiment that might use temperature as a measurement.

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to the State Test

*Directions (5–10):* For each question, write your answer in the spaces provided. Base your answers to questions 5 through 10 on the paragraph and table below.

DISTANCE OF PLANE FLIGHT					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
<b>Airplane A (4.2) grams</b>	5.5 meters	6 meters	5.85 meters	5 meters	5.6 meters
<b>Airplane B (5.6) grams</b>	3 meters	3.5 meters	4 meters	3.25 meters	4.5 meters
<b>Airplane C (6.6) grams</b>	1.75 meters	1.5 meters	2 meters	2.1 meters	2 meters

Rebecca wondered if the type of paper used to construct a paper airplane would affect the distance that the plane flew. She hypothesized that an airplane made of lighter weight paper would fly farther than an airplane made of heavier paper.

Using three pieces of paper, each of a different weight, Rebecca made three paper airplanes. She threw each plane five times and measured the distance of each flight.

- 5 What was Rebecca's hypothesis?

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- 6 What safety precautions should Rebecca use when she conducts her experiment?

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- 7 What are some conditions Rebecca should keep constant for each trial of each paper airplane?

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- 8 What equipment was needed for this experiment?

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- 9 Was Rebecca's hypothesis correct? How do you know?

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- 10 What may have occurred during each trial that might have given Rebecca inaccurate data? How might this experiment be improved?

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**Directions (11–16):** Each question is followed by four choices. Decide which choice is the *best* answer. Circle the answer you have chosen.

- 11** How many independent variables are there in a simple controlled investigation?

(1) none  
(2) one  
(3) two  
(4) three

- 12** Matt is conducting an investigation to answer the following question: “How much light is needed for a spider plant to grow?” What is the independent variable in his experiment?

(1) type of plant  
(2) type of fertilizer  
(3) amount of soil  
(4) amount of light

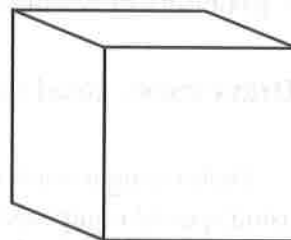
- 13** Part of an experiment involves using a knife to cut apart leaves. As a safety precaution, students should wear

(1) gloves  
(2) filter mask  
(3) boots  
(4) helmets

- 14** The variable that is measured to obtain the results of an investigation is called a(n)

(1) dependent variable  
(2) independent variable  
(3) constant  
(4) trials

- 15** You need to find the density of a cube. Which tools would you need?



$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

(1) ruler and spring scale  
(2) microscope and thermometer  
(3) graduated cylinder and water  
(4) ruler and a balance

- 16** Before designing an experiment, a scientist must

(1) collect data  
(2) identify a question  
(3) draw a conclusion  
(4) carry out an investigation

**S2.1a** Demonstrate appropriate safety procedures  
**S2.3a** Use appropriate safety procedures

A **hazard** is anything that can be dangerous.

A **precaution** is something done to prevent an accident or avoid injury.

Guided  
Instruction

**DIRECTIONS** Read the following information.

Performing a scientific investigation often involves using special equipment and materials. It is always important to handle these things in a safe manner. Misuse or carelessness can lead to an accident.

Before beginning an activity, read the directions and listen to all instructions from your teacher. Make sure you understand the purpose of the investigation the proper use of all equipment, and do not change any of the procedures without permission from the teacher.

Always make sure you understand the **hazards**, or possible dangers, of the experiments that you do in the lab. Hazards include chemical spills, fires, burns, and cuts. Generally, there will be safety symbols, such as those shown below, that will identify these hazards. Be aware of these symbols and what they mean.



Eye Protection



Clothing Protection



Hand safety



Heating safety



Electric safety



Chemical safety



Animal safety



Sharp object



Plant safety

Guided Questions

What is a **hazard**?

What are some hazards the symbols warn about?

There are different safety **precautions** you can take to protect against different hazards. To protect against splashes and spills, wear safety goggles, gloves, and laboratory aprons. To protect against fires and chemicals, wear goggles, tie back long hair, and remove clothing or jewelry that could touch chemicals or flames. Never mix chemicals or use fire without permission from your teacher. While you are working, do not put your hands or anything else into your mouth. When you've finished working, be sure to wash your hands. Keeping a clean workspace can also prevent many accidents.

If an accident does occur, report it to the teacher immediately, no matter how small it may seem. Know where safety equipment is kept, such as the eye wash station and the fume hood, and how to use it. Know where the exits are located and what to do in the case of an emergency. When you finish a lab, safely dispose of any remaining materials, then clean and put away all equipment.

### Guided Questions

What are some **precautions** you can take?

**DIRECTIONS** For each question, write your answer in the spaces provided.

1. What is the first thing that you should do before you start a science investigation?  
\_\_\_\_\_  
\_\_\_\_\_
2. What are some hazards you might encounter during a science investigation?  
\_\_\_\_\_  
\_\_\_\_\_
3. What are some precautions you can take against spilled liquids?  
\_\_\_\_\_  
\_\_\_\_\_
4. Why is it important to clean up your lab space after finishing an experiment?  
\_\_\_\_\_  
\_\_\_\_\_

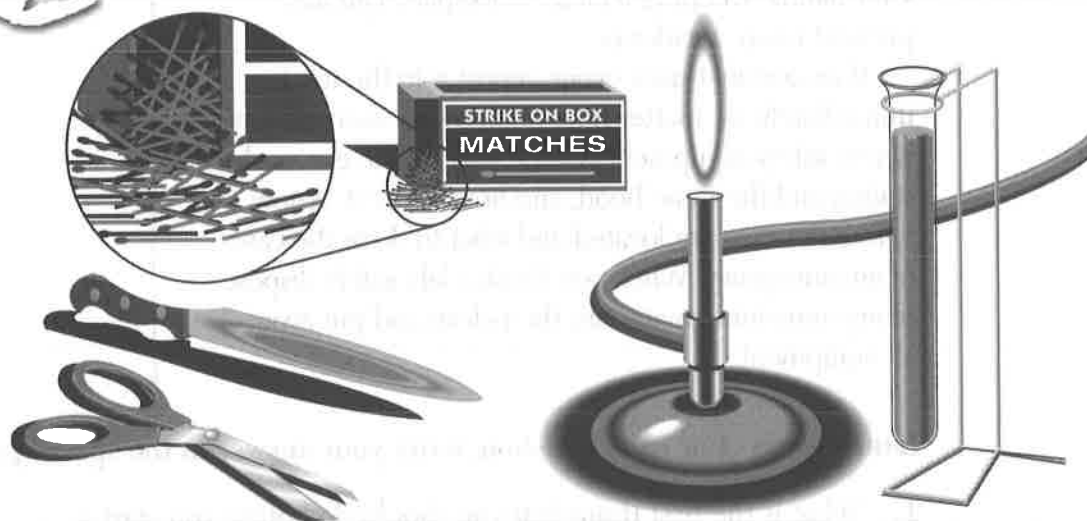
5. What do you do after any accident? Why?

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*Directions (6–9):* For each question, write your answer in the spaces provided. Base your answers to questions 6 through 9 on the pictures below.



6 In the lab setup shown above, what are some safety hazards?

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7 What are some precautions that could be taken to protect against the flame?

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8 What precautions can be taken after handling the test tube?

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- 9 Should the students dump the substance in the test tube into the sink after finishing the experiment? Explain.
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*Directions (10–15):* Each question is followed by four choices. Decide which choice is the *best* answer. Circle the number of the answer you have chosen.

- 10 What should you do if something catches on fire during a lab investigation?

- (1) cover it with a towel
- (2) tell the teacher
- (3) pour water on it
- (4) use a fire extinguisher

- 11 What is the first step of any investigation?

- (1) making a data table
- (2) cleaning up the lab space
- (3) reading the instructions
- (4) putting on safety goggles

- 12 Which of the following is a safety precaution?

- (1) long hair
- (2) an open flame
- (3) a clean workspace
- (4) an unknown chemical

- 13 Something that can cause an accident is called a

- (1) precaution
- (2) hazard
- (3) quality
- (4) chemical

- 14 Which piece of equipment can protect against burns?

- (1) gloves
- (2) hot plate
- (3) helmet
- (4) test tube rack

- 15 The picture below shows an accident.



In response to this accident, a student should

- (1) get a bucket of sand
- (2) get a roll of paper towels
- (3) evacuate the classroom
- (4) alert the teacher

## Lesson 4 Analyze and Display Data

- 2.2.1** Understand the need to question the accuracy of information displayed on a computer because the results produced by a computer maybe affected by incorrect data entry.
- M2.1a** Interpolate and extrapolate from data.
- M2.1b** Quantify patterns and trends.
- M3.1a** Use appropriate scientific tools to solve problems about the natural world.
- S3.1a** Organize results, using appropriate graphs, diagrams, data tables, and other models to show relationships.
- S3.1b** Generate and use scales, create legends, and appropriately label axes.
- S3.2a** Accurately describe the procedures used and the data gathered.
- S3.2b** Identify sources of error and the limitations of data collected.
- S3.2c** Evaluate the original hypothesis in light of the data.
- S3.2d** Formulate and defend explanations and conclusions as they relate to scientific phenomena.
- S3.2e** Form and defend a logical argument about cause-and-effect relationships in an investigation.
- S3.2f** Make predictions based on experimental data.
- S3.2g** Suggest improvements and recommendations for further studying.
- S3.2h** Use and interpret graphs and data tables.
- S3.3** Modify their personal understanding of phenomena based on evaluation of their hypothesis.

Any information that is collected during an investigation is referred to as **data**.  
To **analyze** means to examine closely.

### Guided Instruction

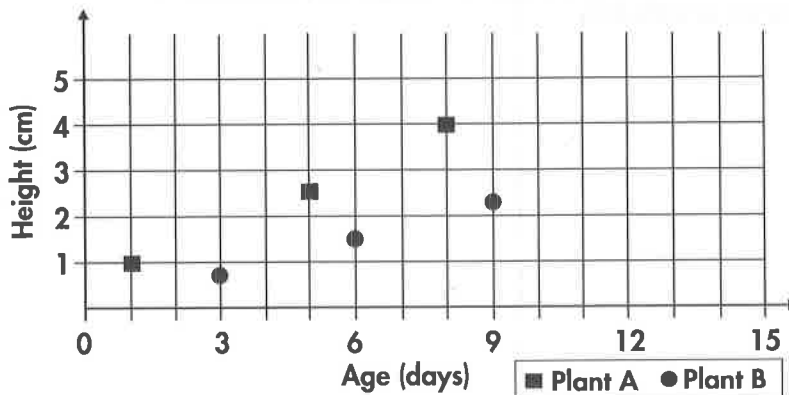
**DIRECTIONS** Read the following information.

The information collected in an experiment is called **data**. Data is often organized into graphs, tables, diagrams, and other models often using computers. This can help to show relationships between variables.

For example, the graph below shows the relationship between the age and height of two young plants. One axis shows age, and the other shows height. Units of measurement are given. Because change in a plant's age causes change in the plant's height, the horizontal axis is labeled "Age."

The pattern of points shown on the graph can be used to make predictions. The graph does not show how tall Plant A was when it was 3 days old. Looking at the graph, you can guess Plant A was about 2 cm tall. Similarly, you can guess that when Plant B is 12 days old, it will be a little less than 4 cm tall.

**GROWTH RATE OF TWO PLANTS**



### Guided Questions

What is **data**?

About how tall will Plant A be at 9 days old?

**INFORMATION  
SYSTEMS**

Computers can help you to assemble, display, and analyze data. However, the data must first be correctly entered into the computer.

Organized data may show trends and be much easier to **analyze**, or examine closely. This can help you interpret your results and see if your hypothesis was correct. Patterns in data might also suggest new hypotheses and explanations. Organizing data into a graph, table, or diagram can help you present and defend your ideas and conclusions.

In addition to sharing your data with others you must be able to explain where the data came from. You must describe the procedures you followed and the tools that you used. Did you make any mistakes in carrying out the procedure? Did you estimate measurements when recording data? If so, you must identify these sources of error. Finally, you must be able to suggest improvements and recommendations for further studying.

**Guided Questions**

Why is organized data easier to **analyze**?

**DIRECTIONS** For each questions, write your answer in the spaces provided.

1. Why is data organized into graphs, tables, diagrams and other models?

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2. Why is it important to choose the appropriate graphic to organize data?

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3. One hundred students were surveyed about who they would vote for. What is the best way to display the results? Explain your answer.

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4. What are sources of error in an experiment? What can be done to improve the quality of data?

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5. What are some things you must be able to communicate at the end of an investigation?

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Apply the  
New York State  
Learning Standards  
to the State Test

*Directions (6–9):* For each question, write your answer in the spaces provided.  
Base your answers to questions 6 through 9 on the table below.

AVERAGE MONTHLY WEATHER FOR BRYCE CANYON NATIONAL PARK, UTAH			
Month	Average High (°F)	Average Low (°F)	Average snowfall (inches)
January	36	4	14.5
February	39	8	10.6
March	44	15	12.4
April	54	23	4.4
May	63	29	1.8
June	75	36	0
July	80	44	0
August	77	43	0
September	72	35	0.1
October	61	26	2.5
November	46	14	5.9
December	39	8	8.8

- 6 What information can be gathered from this table?

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- 7 If you were to organize the data of average high and low temperatures on a line graph, what would be the labels of the axes?

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- 8 If you were planning a trip to Bryce Canyon National Park and enjoyed warm weather, explain what month(s) you would choose.

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- 9 Explain another way you could organize the average snowfall data.

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**Directions (10–13):** Each question is followed by four choices. Decide which choice is the *best* answer. Circle the number of the answer you have chosen.

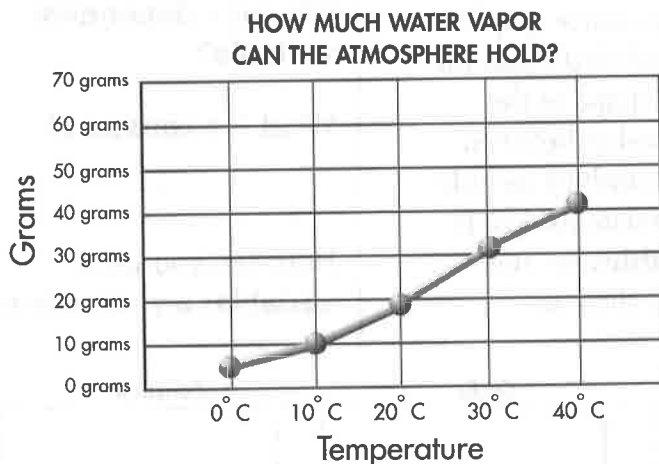
**10** Look at the circle graph below.



What is a limitation of this circle graph?

- (1) It equals 100%.
- (2) It doesn't show which salts make up the ocean.
- (3) It doesn't show the actual volume of each salt in the ocean.
- (4) It doesn't show a ratio of each salt in the ocean.

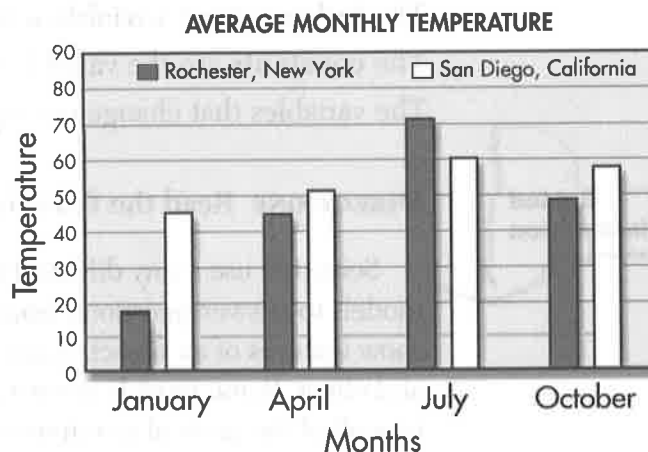
**11** Look at the line graph below.



Predict the number of grams of water the atmosphere could hold at 50°C.

- (1) 62 grams
- (2) 52 grams
- (3) 35 grams
- (4) 25 grams

**12** What conclusions can be made from the data in this graph?



- (1) Average temperatures of the two cities are the same.
- (2) The average temperature of Rochester varies more than that of San Diego.
- (3) The average temperature of Rochester varies less than that of San Diego.
- (4) The average temperature of both cities in August is different.

**13** Using the data in the table below, what kind of graphic would *best* show a trend?

Month	High Temperature (°C)
February	8
March	15
April	18
May	20
June	22
July	27
August	29

- (1) line graph
- (2) circle graph
- (3) data table
- (4) Venn diagram

## Lesson 5 Modeling in Science

- M1.1a** Identify independent and dependent variables.  
**M1.1b** Identify relationships among variables including: direct, indirect, cyclic, constant; identify non-related material.  
**M1.1c** Apply mathematical equations to describe relationships among variables in the natural world.  
**2.2.1** Understand the need to question the accuracy of information displayed on a computer because the results produced by a computer may be affected by incorrect data entry.

The **independent variable** is the part of the experiment that changes.

The **constants** are the variables that are kept the same or controlled in an experiment.

The variables that change or respond in an experiment are the **dependent variables**.

### Guided Instruction

**DIRECTIONS** Read the following information.

Scientists use many different types of scientific models to answer questions. Some models are used to show features of an object. Some models show cause and effect. Some models are structural models showing how all of the parts of a system are connected.

Mathematical equations are models that can be used to show relationships between variables. The equation  $c = \pi d$  shows the relationship between the diameter and circumference of a circle. This equation has the variables  $c$  and  $d$ . Changing the **independent variable**,  $d$ , produces a change in the **dependent variable**,  $c$ . A number that does not change, such as  $\pi$ , is called a **constant**.

Scientists often use equations to produce graphs. Usually, the independent variable is labeled  $x$  and the dependent variable is labeled  $y$ . The shape of the graph can help to identify the relationship between the variables. Different types of relationships include direct, indirect, cyclic, and constant relationships. It is important to recognize when **variables** are not related. In such a case, the graph will show no pattern or trend at all.

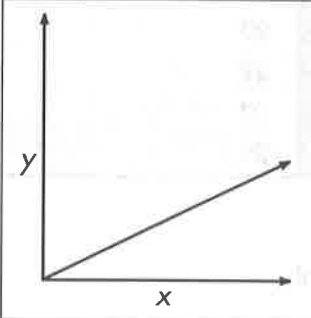
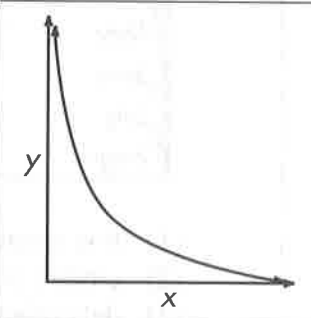
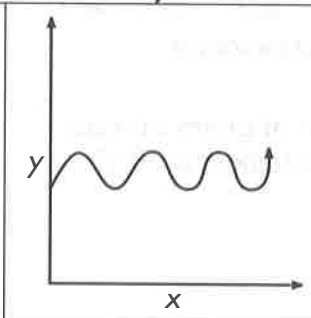
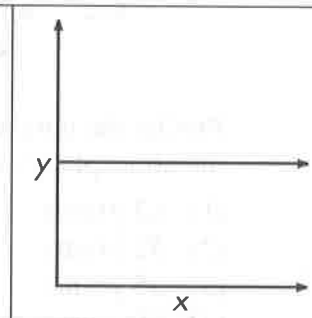
### Guided Questions

What is an **independent variable**?

What is a **dependent variable**?

What is a **constant**?

How can you tell if **variables** are not related?

Direct	Indirect	Cyclic	Constant
			
increase in $x$ leads to an increase in $y$	increase in $x$ leads to a decrease in $y$	a repeating pattern	increase in $x$ ; $y$ is constant

## Guided Questions

Sometimes, however, a scientist will want to make a single prediction about a specific situation. Suppose a scientist had a sled with a mass of 10 kilograms and wanted to predict the amount of force needed to accelerate the sled at a rate of  $5 \text{ m/s}^2$ . The equation that predicts force in this situation is *Force = mass  $\times$  acceleration*. By putting the specific values into the equation, the amount of force can be calculated, as shown below.

$$\begin{aligned}\text{Force} &= \text{mass} \times \text{acceleration} \\ \text{Force} &= 10 \text{ kg} \times 5 \text{ m/s}^2 = 50 \text{ kg} \cdot \text{m/s}^2\end{aligned}$$

When performing calculations such as this, it is very important to keep track of the units associated with each number.

**DIRECTIONS** For each question, write your answer in the spaces provided.

1. What is a scientific model?

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2. What are some ways that a model can be used as a tool?

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3. How is a mathematical equation like a model?

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4. What are some relationships that exist between variables?

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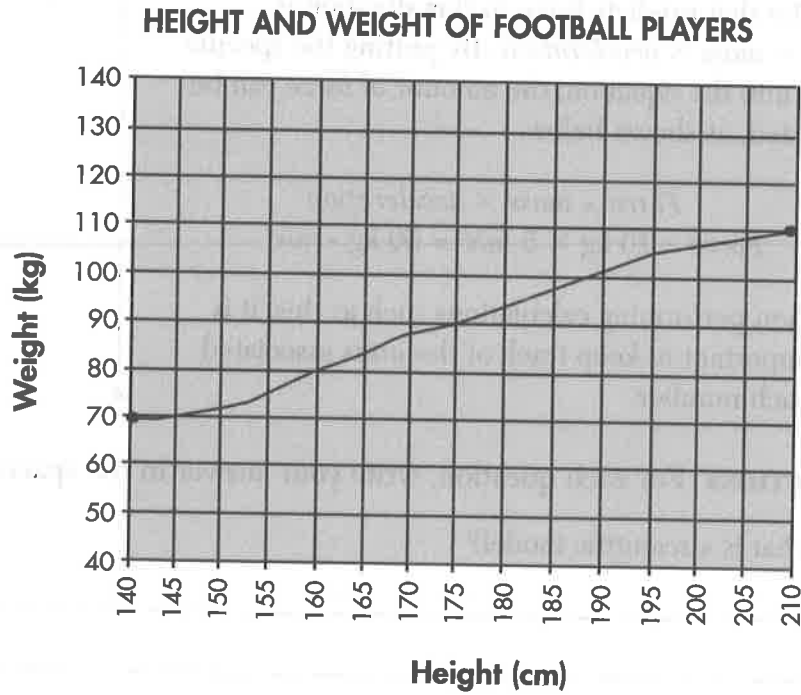
5. A scientist wants to know how much force is needed to launch a certain rocket. Which model should be used to find out? Explain.

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Apply the  
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Learning Standards  
to the State Test

*Directions (6–9):* For each question, write your answer in the spaces provided. Base your answers to questions 6 through 9 on the graph below.



- 6 What variables are shown on the graph?
- \_\_\_\_\_
- 7 Explain which is the independent variable.
- \_\_\_\_\_
- \_\_\_\_\_
- 8 Which type of relationship is shown by the variables?
- \_\_\_\_\_
- 9 Predict the weight of a person who is 1.95 meters tall.
- \_\_\_\_\_
- \_\_\_\_\_

**Directions (10–13):** Each question is followed by four choices. Decide which choice is the *best* answer. Circle the number of the answer you have chosen.

**10** The independent variable in an experiment

- (1) does not change
- (2) changes randomly
- (3) is changed by the investigator
- (4) changes in response to another variable

**11** A number that does not change in an equation is called a

- (1) variable
- (2) constant
- (3) model
- (4) relationship

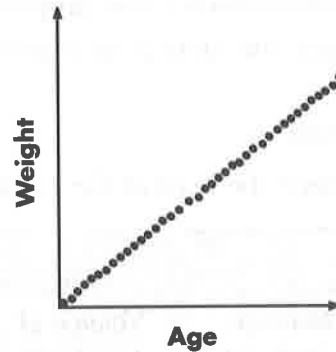
**12** George has a mass of 80 kilograms. He is skating at a velocity of 4 meters per second. Use the equation below to calculate George's momentum.

$$\text{momentum} = \text{mass} \times \text{velocity}$$

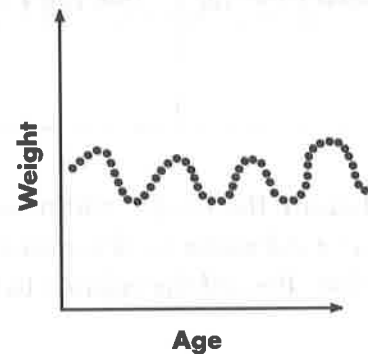
- (1) 20 kg • m/s
- (2) 84 kg • m/s
- (3) 280 kg • m/s
- (4) 320 kg • m/s

**13** Which graph below shows no relationship between age and weight?

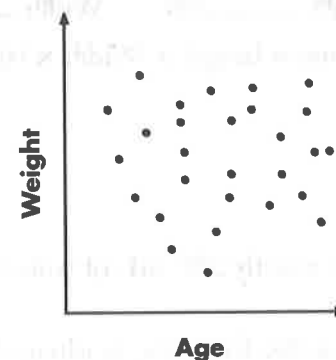
(1)



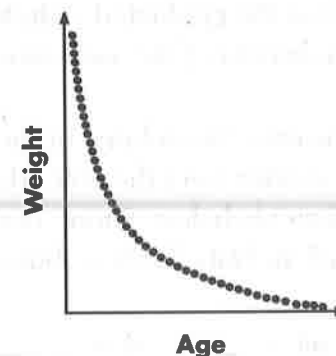
(2)



(3)



(4)



# Performance Task

## Density of Water

### Task:

You will measure some properties of a plastic box. You will then use your measurements to determine the density of water.

### Directions:

- 1 Measure the mass of the empty box. Record the value to the nearest 0.1g in Data Table 1 below.

DATA TABLE 1					
Mass of empty box (g)	Volume of box (cm <sup>3</sup> )	Volume of box (mL)	Mass of box and water (g)	Mass of water (g)	Density of water (g/mL)

- 2 Measure the length, width, and height of the interior of the box to the nearest 0.1 cm. Use a calculator to determine the volume of the box. Show your work in the space below. Record the volume to the nearest 0.1cm<sup>3</sup> in Data Table 1 above.

Length \_\_\_\_\_cm      Width \_\_\_\_\_cm      Height \_\_\_\_\_cm

Volume = Length × Width × Height

- 3 Pour exactly 250 mL of water from the beaker into the graduated cylinder.
- 4 Use water from the graduated cylinder to fill the box to the top. Determine how much water is left in the graduated cylinder. (*Remember to read the fluid level in the graduated cylinder at the bottom of the meniscus.*)
- 5 To measure the volume of the box in mL, subtract the number of milliliters remaining in the cylinder from the 250 mL that you started with. Substitute your value from Step 4 into the formula below. Show your work in the space below. Record your volume to the nearest 1.0 mL in Data Table 1 above.

(250 mL – \_\_\_\_\_mL = \_\_\_\_\_mL)



- 6 Measure the mass of the box filled with water. Record the values to the nearest 0.1 g in Data Table 1 on page PT22.
- 7 To find the mass of the water in the box, subtract the mass of the empty box from the mass of the box and water. Show your work in the space below. Record your value to the nearest 0.1 g in Data Table 1.

Mass of water = Mass of box and water – Mass of empty box

- 8 To calculate the density of water, substitute your values for mass of the water in the box and the volume of the empty box (in mL) in the formula provided. Show your work in the space below. Record your value to the nearest 0.1 g/mL in Data Table 1.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

- 9 Write a hypothesis about the density of the water in a second box that is larger than the box used in this experiment.

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- 10 Examine the data table and make an inference about the relationship between cubic centimeters and milliliters.

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- 11 Pour the water from the box and the graduated cylinder back into the beaker.

- 12 Return all materials.

# Building Stamina®

*Directions (1–17):* Each question is followed by four choices. Decide which choice is the *best* answer. Circle the number of the answer you have chosen.

- 1 Which of the following is a safety rule for the laboratory?
  - (1) Keep your workspace organized.
  - (2) Wash your hands as much as possible.
  - (3) Wear heavy boots.
  - (4) Take good notes.
- 2 Which of the following describes a good hypothesis?
  - (1) correct
  - (2) testable
  - (3) right
  - (4) long
- 3 An object is placed in a box. The box is closed so that the object is not visible. Different people are asked to shake the box and answer questions like, “What size are the objects in the box?” What skill are these people being asked to use?
  - (1) measuring
  - (2) inferring
  - (3) predicting
  - (4) explaining
- 4 Which of the following is acceptable during the scientific process?
  - (1) discovering the hypothesis is incorrect
  - (2) ignoring data that disagrees with the hypothesis
  - (3) selecting a hypothesis once the investigation is complete
  - (4) ignoring hazards in the investigation
- 5 In an investigation that tests the strength of three different shapes of magnets by attracting identical paper clips, what is the independent variable?
  - (1) the weight of paper clips
  - (2) the shapes of paper clips
  - (3) the shapes of magnets
  - (4) the strength of magnets
- 6 Which of the following is another word for a hypothesis?
  - (1) question
  - (2) data
  - (3) prediction
  - (4) fact
- 7 Look at the data display below. This type of display is called a

PLANT GROWTH AND TEMPERATURE			
Temp (°C)	Plant Height (cm)		
	Day 1	Day 10	Day 20
10°C	2	3	4
15°C	2	5	8
20°C	2	10	19
25°C	2	7	13

- (1) diagram
- (2) bar graph
- (3) line graph
- (4) table



- 8 Jill is conducting an experiment to answer the question: "How does the amount of sunlight a rose bush receives affect the size of its flowers?"

What is the dependent variable in this experiment?

- (1) amount of sunlight
- (2) amount of fertilizer
- (3) size of flower
- (4) size of rose bush

- 9 Students are testing the temperature of different water samples. Which scientific tool would be needed to do the investigation?

- (1) hand lens
- (2) thermometer
- (3) balance
- (4) mirror

- 10 Students are making a model of the human heart. This model shows the four chambers of the heart. The vessels are labeled to show where the blood goes when it leaves the heart and where the blood comes from that enters the heart. Which of the following information cannot be learned from this model?

- (1) different parts of the heart
- (2) which foods cause heart disease
- (3) direction of blood flow
- (4) which blood vessel carries blood to the heart

- 11 The results of an investigation are shown below.

WEEKLY RAINFALL (cm)						
Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
6	2	0	0	2	2	1

Which of the following is an observation from the investigation?

- (1) Wednesday was warm.
  - (2) It rained 6 cm during the week.
  - (3) It did not rain on Thursday.
  - (4) It always rains on Saturday.
- 12 What should you do if something catches fire during an investigation?
- (1) Run out of the exit.
  - (2) Pour water on it.
  - (3) Tell the teacher.
  - (4) Walk away quietly.
- 13 Which tool is used only for observing?
- (1) ruler
  - (2) balance
  - (3) hand lens
  - (4) graduated cylinder

- 14 What safety hazard is indicated by the symbol below?

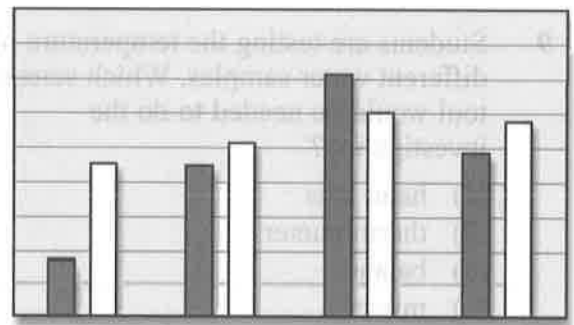


- (1) fire
  - (2) poison
  - (3) sharp object
  - (4) electrical shock
- 15 Which of the following is an inference?
- (1) The cat has white fur.
  - (2) The cat has sharp teeth.
  - (3) The cat has a loud purr.
  - (4) The cat will have kittens someday.

- 16 Which of these is the best question for an investigation?

- (1) How fast can birds fly?
- (2) How much table salt can dissolve in water?
- (3) Why is the sky blue?
- (4) What is the best plant fertilizer?

- 17 Look at the data display below.



This type of display is called a

- (1) scatter plot
- (2) bar graph
- (3) line graph
- (4) data table

*Directions (18–21):* For each question, write your answer in the spaces provided.

- 18** Distinguish between a dependent and an independent variable.

Independent Variable \_\_\_\_\_

\_\_\_\_\_

Dependent Variable \_\_\_\_\_

\_\_\_\_\_

- 19** Explain why it is necessary to be able to repeat scientific investigations.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 20** Arrange the following steps of a scientific investigation in the correct order: (analyzing the data, designing an experiment, gathering data, selecting a hypothesis).

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 21 The data table below was prepared for an investigation.

Time (minutes)	TEMPERATURE (°C)	
	Small Beaker	Large Beaker
0		
1		
2		
3		
4		
5		

Write a likely hypothesis for this experiment.

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